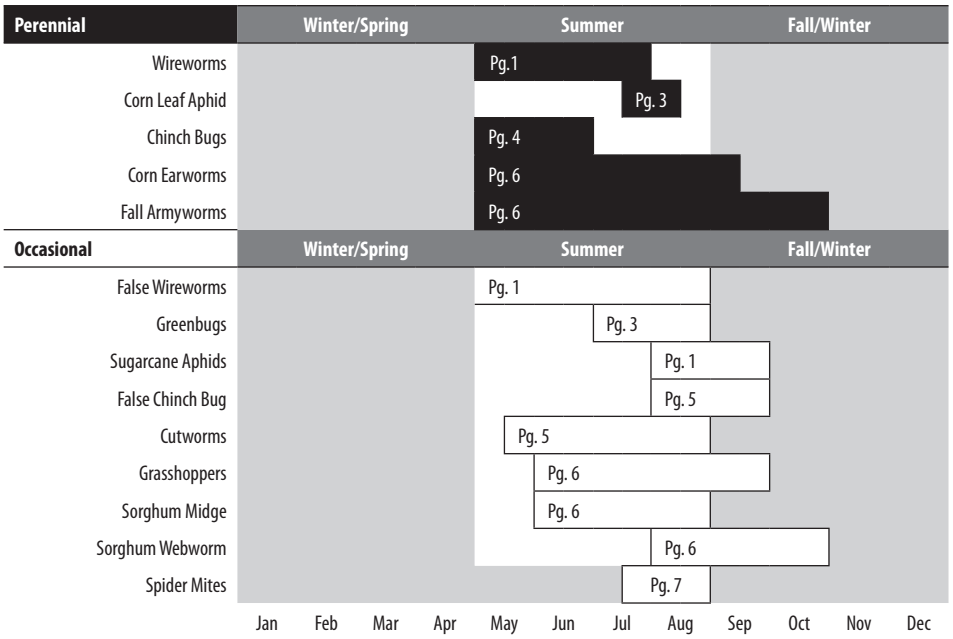
Sorghum INSECT PEST MANAGEMENT *2022*

K-STATE Research and Extension
Kansas State University
Agricultural Experiment Station
and Cooperative Extension Service

How to Use This Guide

This publication was prepared to help producers manage insect populations with the best available methods proven practical under Kansas conditions. It is revised annually and intended for use during this calendar year. Users should be aware that pesticide label directions and restrictions are subject to change, and some may have changed since this publication was written. The economics of control should be considered in any pest management decision. Because costs vary greatly over time and are influenced by factors beyond the scope of this publication, product cost in general is not considered a reason for including or omitting specific insecticide products in these recommendations. Always compare product price, safety and availability when making treatment decisions. The user is responsible for proper use and should read the label carefully before making a pesticide application. It is illegal to use a pesticide in a manner inconsistent with the label. The label tells where, how and when the product can be used.

For more information on pests covered in this publication or other crop pests visit *entomology.k-state.edu/extension/insect-information/crop-pests*. Kansas State University entomologists assume no responsibility for product performance, personal injury, property damage, or other types of loss resulting from the handling or use of the pesticides listed.



Using Insecticides Safely

Injury or death can result from swallowing, inhaling, or prolonged skin contact with insecticides. The risk of injury from ingestion is greatest among pets, livestock, and young children. Skin absorption, and sometimes inhalation, pose the greatest risk to users. Handle pesticides with care and use only when needed. Avoid spilling concentrates on the skin or clothing.

If a spill occurs, remove contaminated clothing immediately, and wash with soap and water. If in the eyes, flush with water for 15 minutes and seek prompt medical attention. If exposed and in need of medical treatment, take the pesticide label with you. For poison control information contact the Mid-America Poison Control Center at 800-222-1222.

Wear protective equipment (respirators, clothing) as specified on the label. Bathe and change clothing frequently. Launder contaminated clothing separately. Protect fish, wildlife, and other nontarget organisms. Do not dispose of unused pesticides where the runoff may contaminate streams, lakes, or drinking water supplies, nor apply in a manner that could pollute such sites.

Consider the presence of honeybees before applying insecticides. Avoid drift to beehives or adjacent blooming crops. Notify the bee owner before applications are made in the general vicinity. Applying treatment late in the day when bees are not foraging may help to reduce the risk.

Belowground Pests

Wireworms and Other Seed-Attacking Pests

Most insects that attack sorghum seeds and seedling plants before emergence can be controlled with seed treatments that contain clothianidin (Poncho), imidacloprid (numerous products), or thiamethoxam (Cruiser).

Aboveground Pests

Aphids

Sugarcane Aphid, *Melanaphis sacchari*

The sugarcane aphid (SCA) is pale yellow with short, dark 'tailpipes' (cornicles) and dark feet (tarsi). The SCA has caused serious and widespread economic losses in Texas and other southern states since its arrival in 2013. It first reached economic levels in Kansas in 2015, and problems peaked in 2016. Economic infestations in Kansas have been far less frequent since 2017. The decline in infestation frequency and intensity may be the result of improved control of the aphid in source regions to the south, combined with rapid adaptation to the pest by a broad complex of aphid natural enemies, which proliferate in wheat, and then move into summer crops.

The sugarcane aphid is capable of very high rates of reproduction on susceptible

sorghums (6 to 9 nymphs per female per day in warm weather) and produces copious amounts of honeydew. Feeding by SCA causes leaf chlorosis in the form of reddish spots that gradually coalesce into large lesions, somewhat similar to greenbug damage. Feeding may continue through the soft stages of grain fill and aphids entering the heads can reduce panicle size and seed weight and foul heads with honeydew and sooty mold, which can impede harvest.

Timing of Infestation

Plants are vulnerable to infestation by SCA at any growth stage, but Kansas sorghum is most at risk from boot stage onward, however infestations prior to boot stage are more damaging and more costly to control. The SCA cannot overwinter in Kansas and infestations are initiated annually by winged aphids carried from southern latitudes; the timing, extent and exact regions affected are difficult to predict and largely a function of wind direction during periods of aphid flight in Texas and Oklahoma. Infestations begin when large swarms of winged aphids settle in a field and begin to establish colonies. Kansas becomes at risk only after SCA infestations to the south mature and produce winged migrants. Growers are advised to plant sorghum as early as feasible to maximize plant growth and maturity before aphids arrive. They are also advised to monitor the myFields SCA site (www.myfields.info) for real-time updates during the growing season so they can initiate scouting when the map shows infestations establishing in Oklahoma.

Temperature and Weather Effects

Ripening grain remains susceptible to damage through hard dough stages, and aphids can remain feeding on the plant as long as any green tissue is present. In Kansas, infestations may occur late enough that they do not need to be sprayed. As overnight temperatures drop in the fall, a larger number of aphids can be tolerated, especially after the black layer forms on the seed. The extent to which accumulations of honeydew can cause harvesting problems appears to depend on weather conditions. Significant rainfall can rinse off honeydew, and stickiness can be diminished by hot dry winds and growth of sooty mold. Provided grain has ripened and there is no indication of lodging, the best approach to a sticky field is to simply wait for the honeydew to weather away. Many residual aphids may also die off during this period. Most trials suggest little to no benefit of applying desiccants such as glyphosate or sodium chlorate, and using a dessicant alone will only serve to drive aphids into the heads. If populations persist, an insecticide may be required. Transform at 0.75 fl. oz. per acre is sufficient to knock down aphids in late season.

An important factor affecting treatment decisions will be the onset of low overnight temperatures that arrest aphid feeding and reproduction. The aphids may survive for some time in cold weather, but they will do little further damage to the crop once they are only able to feed for an hour or two during the warmest part of the day. The recommended insecticides also become much less effective, as they require ingestion by the aphids to have maximum efficacy. Complicating matters is the fact that the SCA gradually transitions to a 'winter phenotype' in the fall, which can survive several successive overnight freezes. However, these winter forms are just in 'survival mode', have very low rates of feeding and reproduction, and will eventually die as winter approaches.

Forage Sorghum

Many forage sorghums grown for silage have proven highly susceptible to SCA. Feeding damage can result in significant loss of biomass and nutritional content. If the aphids are allowed to kill the plants, the palatability and quality of the forage will be significantly reduced. Unless the plants are very young, it is almost impossible to obtain good control of sugarcane aphid in forage sorghums with insecticides because of the difficulty of getting good spray coverage within these high-density plantings. Forage sorghum that becomes infested is best salvaged by immediately cutting, even if maximum plant height has not been reached. Seed producers now offer a number of forage sorghum lines that claim various levels of tolerance/resistance to SCA.

Resistant Hybrids

Although many commercial hybrids remain susceptible to SCA damage, many souces of SCA resistance were identified in breeding lines and quickly moved into commercial cultivars. Now, virtually all seed suppliers offer one or more varieties that will perform and yield well under moderate SCA pressure, although they still require scouting. Resistant hybrids will slow sugarcane aphid population growth and reduce the chances an infestation will surpass the economic threshold, thus facilitating the evolution of natural biological control by our native complex of aphid predators and parasitoids. A number of SCA-resistant cultivars have not yielded well under Kansas conditions, so producers should ask their seed suppliers about hybrids that have yielded well in their particular region.

Management Considerations

Producers and consultants should begin scouting fields just prior to boot stage. Before monitoring sorghum for aphids, download the scouting guide for sugarcane aphid in Kansas: *myfields.info/sca*. This guide will assist with identification of the aphid and determining the need to spray. It is important to spray immediately once the economic threshold is surpassed, otherwise infestations can explode, leading to serious crop losses and the export of winged aphids to other nearby fields.

Insecticides remain approved for use against sugarcane aphid in Kansas sorghum in 2021:

- Transform (sulfoxaflor), Dow Agrosciences, @ 1.0 oz./acre (EPA Section 18);
- Sivanto (flupyradifurone), Bayer Crop Science, @ 4.0 oz./acre.

Field trials show good efficacy of the above materials against the sugarcane aphid; both have the ability to penetrate leaves through translaminar movement and kill aphids feeding on the undersides. Maximum efficacy will be achieved by application in a large volume of water, preferably 20 gallons per acre or GPA (minimum 10 GPA) by ground or 5 GPA from the air. Laboratory trials indicate that sulfoxaflor (Transform) is relatively safe for important aphid predators such as lady beetles and lacewings and thus can be considered IPM-compatible. This is true to a lesser extent for flupyradifurone (Sivanto), but various trials have indicated a much longer period of residual activity for this material. Both insecticides have annual application limits and growers are advised to rotate them if follow-up applications are required. Note also that preharvest intervals will be a factor to consider when treating late-season infestations, so applicators should read labels carefully and keep a log of all treatments for each field. Because sulfoxaflor and flupyradifurone are absorbed by leaves and eventually metabolized by the plant, reinfestation can occur if large numbers of winged aphids continue to settle in the field.

When inspecting fields for treatment efficacy, note whether live aphids are winged or wingless, as the former may indicate continued immigration rather than control failure. Do not attempt to control sugarcane aphid with contact insecticides that have broad-spectrum activity; these include all pyrethroid and organophosphate materials and combinations thereof. Field trials indicate these materials are generally not effective, harm beneficial species, and often result in higher aphid numbers than unsprayed control plots. Sorghum headworm infestations are often present when SCA is observed in a field, since this pest migrates using the same weather events. When choosing an insecticide to control headworms, use products that are less harmful to natural enemies such as Prevathon or Blackhawk, as these have proven compatible with Transform and Sivanto and less selective materials risk flaring the aphids. The biological agents for head worm control (Heligen and Fawligen) will also be safe for beneficial species. We do not recommend insecticidal seed treatments in Kansas where infestation during seedling stages is unlikely.

Corn Leaf Aphid

These aphids are about 1/16-inch long and dark-green or bluish. They are usually found in the whorl of plants during vegetative growth stages, often extending over the upper surfaces of the leaves. In early stages, plants can tolerate relatively large populations of corn leaf aphids without measurable impact, and populations usually decline rapidly before boot stage. Control at this stage is not necessary and the presence of these aphids is generally considered to be beneficial because they serve to attract and multiply populations of aphid natural enemies that contribute to control of greenbug and sugarcane aphid that occur later in the crop. However, recent outbreaks of SCA in Kansas have enabled corn leaf aphids to escape control late in the season and cause problems infesting heads together with this new invasive species. Under these conditions, corn leaf aphids probably exacerbate reductions in seed weight caused by SCA and will contribute to the fouling of heads with honeydew. Fortunately, corn leaf aphids will be controlled by any insecticide application directed at SCA.

Greenbug

Greenbugs are small, lime-green aphids that form colonies on undersides of leaves. They have a dark green line down the middle of the back and antennae as long as or longer than their body. Reproductive capacity is high; all individuals are females that mature within five to seven days in warm weather and produce two to three offspring per day for up to two weeks. While feeding, greenbugs inject toxic saliva, destroying chlorophyll in the leaves and turning them red or rusty brown. As plants deteriorate, winged forms develop that are capable of dispersal over great distances. Greenbug damage to Kansas sorghum has been rare since 2000, but mixed infestations are now occurring with the invasive sugarcane aphid in fields where both species are able to escape biological control together. As in the case of SCA, greenbug infestations in Kansas tend to occur in later stages of plant development when there is significant migration of winged forms from more southern latitudes. Infestations that occur after panicle emergence can cause flower sterility, but greenbugs cannot feed on ripening grain. However, mixed

Sugarcane Aphid Management Options**

Insecticide	Rate
Afidopyropen (Sefina)	0.02 lb. ai/acre (6.0 fl. oz./acre)
Flupyradifurone (Sivanto)	0.052 to 0.091 lb. a.i./acre (4.0 – 7.0 fl. oz./acre)
Sulfoxaflor (Transform)	0.023 to 0.047 lb. a.i./acre (0.75 - 1.5 oz./acre)

Corn Leaf Aphid Management Options**

Insecticide	Rate
Alpha-cypermethrin (Fastac EC)	0.02 to 0.025 lb. a.i./acre (3.2 to 3.9 fl. oz./acre)

Greenbug Management Options**

Insecticide	Rate
Alpha-cypermethrin (Fastac CS)	0.02 to 0.025 lb. a.i./acre (3.2 to 3.8 fl. oz./acre)
Dimethoate (Dimethoate or Dimate)	0.25 to 0.5 lb. a.i./acre
Flupyradifurone (Sivanto)	0.091 to 0.182 lb. a.i./acre (7.0 to 14.0 fl. oz.)
Malathion 57	1.5 pints/acre
Methidathion (Supracide 2E)	Section 24(C), 2 pints/acre

infestations have been common where greenbugs feed together with SCA on lower leaves. The presence of tan-colored mummies caused by the greenbug parasitoid, *Lysiphlebus testaceipes*, within SCA colonies is a sign that greenbugs have been in the mix, as the wasp is unable to parasitize the SCA.

Refer to the Greenbug Treatment Guide below for threshold values at various growth stages. For example, an infestation of 10 to 25 greenbugs per plant (based on counts from 25 plants or more) is considered threatening at the one-leaf stage. The infestation may increase or decline depending on the presence of natural enemies such as lady beetles, lacewings and parasitic wasps. Continue to monitor and treat fields if populations increase. An infestation at the one-leaf stage that averages 25 to 50 greenbugs per plant poses a higher risk with serious stand loss likely. Prompt control would be recommended. As plants develop, beneficial insects become increasingly important as agents of greenbug control, and their relative abundance should temper treatment decisions.

Resistant hybrids have been useful for reducing greenbug damage. Currently, most commercial hybrids are no longer checked for greenbug resistance prior to release, given the demise of greenbug as a key pest in sorghum. Going forward, plant breeding efforts will likely focus on resistance to sugarcane aphid, and early research suggests that SCA resistance traits will diminish the benefits greenbugs currently experience when forming mixed colonies with this species.

Seed Treatments

The use of insecticidal seed treatments in Kansas sorghum is only justified if damaging populations of seed-destroying insects are known to be present in the field, or if there is an expected risk of chinch bug migration from an adjacent wheat field. The use of seed treatments for the sole purpose of preventing aphid infestations is not justified in Kansas for early-planted sorghum.

Bugs

Chinch Bug

Adults are small, black bugs about ⅛ inch long with white wings folded over the back. Two small, dark, triangular markings appear near the mid-portion of the wings. Immatures are bright red after hatching, then darken and become gray as they approach maturity. A white band on the upper side of the first abdominal segment is visible until wing buds grow to cover it. Overwintered adults emerge in early spring and fly to small grains where they mate and produce the first generation. Most problems in sorghum occur when large groups of immature, wingless nymphs migrate from maturing wheat fields and invade adjacent sorghum fields where they complete development. Because nymphs are flightless, various barrier treatments and trap crops historically have been used to protect the margins of emerging sorghum fields. Occasionally, adults fly into sorghum either directly from overwintering grasses, late-maturing wheat or from other sorghum fields.

Problems with this insect were historically confined to eastern and central Kansas, with damage beginning in May or June, but in recent years, second generation chinch bugs have been infesting emerging panicles and causing direct damage to grain over a much wider geographic area in the state. Control of second-generation chinch bugs on large plants is difficult to achieve with contact insecticides because of their habit of hiding behind leaf sheaths. Fortunately, insecticides targeting the sugarcane aphid will likely provide some control of late-season chinch bugs as well.

The risk of first generation damage is greater where sorghum is planted next to thin stands of wheat. Seedling sorghum is most vulnerable, and seven to 10 bugs per plant will cause stunting, poor root development and stand reduction. Larger plants can tolerate more bugs, but severe infestations can cause stunting, lodging,

Greenbug Treatment Guide**

	Based on average number of greenbugs per plant		
Plant growth stage[2]	**Threatening level**	**Treatment level[3]**	**Based on visual rating[3]**
0- to 1-leaf stage	10 – 25	25 – 50	Colonies or numerous winged adults present on majority of plants. May be risky to wait until visible damage is obvious.
3-leaf stage	25	50 – 100	As above, before general signs of stress are visible. Light to threatening levels often decline naturally.
5-leaf stage	50	150 – 300	When majority of plants are infested with rapidly increasing colonies of greenbugs and initial signs of reddening start to appear.
Mid-whorl stage, about one month after emergence	200	300 – 600	When majority of plants are infested with rapidly increasing colonies, but before leaves begin to die. Damaging levels uncommon at this stage, but beginning infestations are often starting to appear.
Late whorl through soft dough stages	700	1,000	Some lower leaves beginning to become wet and sticky with honeydew. Some leaves yellowing and reddening with occasional leaves drying. Small to large colonies present and increasing on the majority of plants.

[1]One leaf stage means collar of first leaf visible, same system for third and fifth leaf stages.

[2]Assumes minimal beneficial activity. Remember frequent field visits are usually necessary to make wise decisions.

and yield loss. Using seed treatments: clothianidin (Poncho), imidacloprid (numerous products) and thiamethoxam (Cruiser) at planting can decrease chinch bug damage and can protect plants for up to 3 weeks. Growers should use followup sprays on border rows if protection wears off before the end of chinch bug migration. Locally significant populations developed throughout north and south central Kansas in 2018 resulting in some mid-season lodging. See MF3107, *Chinch Bug* (*ksre.ksu.edu/bookstore/pubs/MF3107.pdf*).

False Chinch Bug

Similar to chinch bugs in size and appearance, false chinch bug nymphs are grayish to brown, and may be tinged with yellow rather than bright orange. Adults are gray to brown with transparent wings, whereas chinch bug adults are black with white wings with a black triangle. False chinch bugs occasionally become abundant when conditions favor survival on various weed hosts, particularly wild mustards. They have a wide host range and as many as 4 to 5 generations per year. Fields planted no-till into wheat stubble where weed control was delayed until just before planting, and fields bordering weedy areas are most at risk. False chinch bugs spend little time on sorghum plants but abundant populations on seedlings can reduce stands. Adults can swarm into sorghum fields later in the season; infestations averaging 140 bugs per panicle during milk stage are considered damaging. If swarms of adults are spotty in a field, it is usually hard to justify field-wide treatment. See MF3047, False Chinch Bug: *ksre.ksu.edu/bookstore/pubs/MF3047.pdf*.

Tarnished Plant Bug

Also known as lygus bugs, the tarished plant bug is a pest of many crops and can build large populations in fields of alfalfa and cotton. When alfalfa fields are cut, adult bugs may move into nearby fields of ripening sorghum and attack milk stage grain, leaving blasted seed capsules. It is wise to try and avoid cutting alfalfa fields while neighboring sorghum fields are filling grain. The advent of the invasive sugarcane aphid appeared to be associated with large populations of lygus bugs in 2016 and more extensive damage to grain by this species in central Kansas. Fortunately, insecticide applications targeting SCA can be expected to provide some control of these various bug species as well.

Caterpillars

Cutworms

Cutworm damage to sorghum is infrequent, but growers should be alert when early season cutworm damage has occurred in neighboring cornfields. The crop is at risk in the two weeks after planting, so scout fields during and shortly after emergence.

Rescue treatments should be considered if a majority of larvae are less than ½-inch long. Worms of this size can destroy four to six plants each before completing development. Older larvae are harder to kill and less is gained by controlling them because they have already caused most of their damage.

Consider the amount of stand reduction that can be tolerated before deciding to treat. If the minimum stand density recommended for a particular hybrid under your management program is 40,000 plants per acre and you have 50,000, then you can tolerate a stand reduction of 20 percent before treatment becomes economically justified, assuming losses will be even across the field. If cutworm damage is localized in certain areas, spot treatments applied to affected areas will be more cost effective than treating the whole field.

Other factors that affect the decision to treat include the length of the areas where plants are missing in a row and the planting date of the sorghum. Skips of less than 2 feet may be partially compensated for by plant tillering, but longer areas are of more concern. Sorghum planted earlier than mid-June tillers more than sorghum planted later, making later plantings less able to compensate for cutworm stand

Chinch Bug Management Options (Foliar Treatments)**

Insecticide	Rate
Alpha-cypermethrin (Fastac CS)	3.2 to 3.8 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.019 to 0.022 lb. a.i./acre (2.0 to 2.8 fl. oz.)
Carbaryl (Sevin)	1.5 to 2 lb. a.i./acre
Deltamethrin (Delta Gold)	0.015 to 0.022 lb. a.i./acre (1.3 to 1.9 fl. oz.)
Esfenvalerate (Asana XL 0.66)	0.03 to 0.05 lb. a.i./acre (5.8 to 9.6 fl. oz.)
Gamma-cyhalothrin (Proaxis)	0.015 lb. a.i./acre (3.84 fl. oz.)
Lambda-cyhalothrin (numerous products)	0.03 lb. a.i./acre
Zeta-cypermethrin (Mustang MAXX, Respect EC, etc.)	0.02 to 0.025 lb. a.i./acre (3.2 to 4.0 fl. oz.)

False Chinch Bug Management Options**

Insecticide	Rate
Alpha-cypermethrin (Fastac CS)	3.2 to 3.8 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.010 to 0.022 lb. a.i./acre (1.3 to 2.8 fl. oz.)
Zeta-cypermethrin (Mustang MAXX, Respect EC)	0.02 to 0.025 lb. a.i./acre (3.2 to 4.0 fl. oz.)

reduction. If a decision is made to replant, ensure that cutworms have all pupated.

Corn Earworm

Corn earworm and fall armyworm, i.e., "headworm" populations were significant in 2019 throughout north central Kansas, but not in 2020/2021. Some reports of insecticides not working as well as expected have been received, however, many growers are satisfied. Timing and amount of carrier are always important relative to pest control and applications for headworms are no different. It is always a good idea to leave an untreated "check" strip whenever possible to help evaluate insecticide efficacy.

Fall Armyworm

This is another moth that migrates north annually from southern states. It arrives in Kansas in July and lays eggs on corn, sorghum and other summer crops. Damage to sorghum may occur from July to the first frost. Feeding during the whorl stages causes large, irregular perforations in the foliage that are evident as leaves unfold, making the plant appear ragged. Late planted fields may suffer more damage if attacked while plants are small.

Leaf damage is non-economic and larvae feeding within the whorl are protected from contact insecticides, making control at this stage impractical. Do not consider treatment unless 75 percent of plants show fresh damage and there are one or two live larvae per plant. Mixed infestations with corn earworm can occur in ripening heads and should be assessed the same as for corn earworm. There is also a biological product highly specific for fall armyworm, Fawligen®, which is comparable to Heligen® and produced by the same company (*agbitech.com*). These products can be combined in a single application for protection against both species.

Sorghum Webworm

This problem is usually confined to southeast Kansas. Damage is caused by small, fuzzy, striped worms that feed in developing heads. There are several overlapping generations, and damage tends to be more severe in late-planted fields and in varieties with compact heads. Larvae are active from August to October. Infestations do not injure mature seed. Hot, dry weather contributes to natural mortality. Control or mow Johnsongrass because it serves as a reservoir for this pest. Destroying stubble can reduce populations of overwintering larvae. Kansas growers should begin scouting fields by mid-August and consider treatment where infestations average five or more worms per head during the early post-bloom period.

Sorghum Midge

These are tiny orange/reddish midges barely ¼ inch long. Sorghum midge is a significant pest of sorghum throughout subtropical regions, but historically rare north of the OK border. The life cycle can be completed in 21 days and there can be many generations per year. Adult midges lay eggs in flowers at anthesis and individual larvae develop within individual seed capsules, and may blast the grain. Empty seed capsules tend to be distributed up and down the length of the entire panicle, interspersed with healthy seeds.

Scout for midge at onset of flowering by striking a minimum of 10 heads into a white plastic bucket at five locations in the field. Look for small, red or orange midges. The economic threshold is an average of one midge per head.

Miscellaneous Pests

Grasshoppers

Fields and border areas should be scouted in early summer while grasshoppers are small. Field borders may need treatment if grasshopper nymphs are abundant (15 to 20 per square yard) to prevent migration into the sorghum. In the field, populations of five to eight nymphs per square yard justify treatment.

Cutworm Management Options**

Insecticide	Rate
Alpha-cypermethrin (Fastac CS)	1.3 to 3.8 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.008 to 0.010 lb. a.i./acre (1.0 to 1.3 fl. oz.)
Deltamethrin (Delta Gold)	0.012 to 0.018 lb. a.i./acre (1 to 1.5 fl. oz.)
Esfenvalerate (Asana XL 0.66)	0.03 to 0.05 lb. a.i./acre (5.8 to 9.6 fl. oz.)
Gamma-cyhalothrin (Proaxis)	0.0075 to 0.01 lb. a.i./acre (1.92 to 2.56 fl. oz.)
Lambda-cyhalothrin (numerous products)	0.015 to 0.02 lb. a.i./acre
Zeta-cypermethrin (Mustang MAXX, Respect EC, etc.)	0.008 to 0.025 lb. a.i./acre (1.28 to 4.0 fl. oz.)

Spider Mites

Spider mite problems are most common in southwestern Kansas. Infestations develop on the undersides of lower leaves and may expand rapidly to upper portions of the plant. This occurs as the plant enters the reproductive stages, especially during periods of hot, dry weather that stresses plants and favors mite growth and reproduction.

Effective mite management requires several elements: frequent inspection of fields, prudent use of insecticides and miticides, careful timing of applications, and thorough coverage with sprays. Treatment is recommended when a majority of plants are infested with expanding colonies on lower leaves and some mites can be seen migrating up into the midsection of the plant. Do not delay treatment. Infestations that become established throughout the canopy are difficult to control.

Most eggs survive chemical sprays, so a second treatment usually is required for large numbers of eggs, regardless of the kill rate achieved on adults and nymphs. Examine infested leaves on several plants under a hand lens every few days after treatment to determine when most eggs have hatched. If active life stages appear to have survived the initial treatment, consider changing to a different miticide and altering application techniques to achieve better coverage. The goal should be to maintain functional leaves in the upper ⅔ of the canopy until the hard dough stage.

Label Terminology

The waiting or preharvest interval (PHI) refers to the time that must elapse between application and harvest. The interval usually is different for forage use as compared to grain harvest, but when not specified, the interval usually is the same regardless of use of the treated product. The waiting interval does not signify how long an insecticide will provide control following application. The restricted entry interval (REI) specifies the time that must elapse before workers can safely return to work in treated fields without the use of protective clothing and/or equipment.

Some pesticides are classified for Restricted Use. This classification means that individuals (private or commercial) must be certified by the Kansas Department of Agriculture before purchasing or using these products. Some pesticide use may be permitted by means of State of Kansas Special Local Needs (SLN) labels. The law requires possession of this label when using a product for a SLN purpose.

Endangered Species

EPA's Endangered Species Protection Program (ESPP) helps promote the recovery of endangered species. If limitations on pesticide use are necessary to protect listed species in a certain geographic area, the information is relayed through Endangered Species Protection bulletins. Pesticide labels may direct you to the local Extension office. Information is also online at *epa.gov/espp/bulletins.htm*.

The Worker Protection Standard

The Worker Protection Standard (WPS) is a series of federal regulations pertaining to pesticides used in agricultural plant production on farms, forests, nurseries and greenhouses. You must comply with these regulations if you are an agricultural pesticide user and/or an employer of agricultural workers or pesticide handlers. For more complete information, consult the U.S. Environmental Protection Agency publication *The Worker Protection Standard for Agricultural Pesticides — How to Comply, What Employers Need to Know*. This publication is available at your local K-State Research and Extension office.

Corn Earworm Management Options**

Insecticide	Rate
Alpha-cypermethrin (Fastac CS)	1.8 to 3.8 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.010 to 0.022 lb. a.i./acre (1.3 to 2.8 fl. oz.)
Chlorantraniliprole (Prevathon)	14.0 to 20.0 fl. oz./acre
Deltamethrin (Delta Gold)	0.012 to 0.018 lb. a.i./acre (1 to 1.5 fl. oz.)
Esfenvalerate (Asana XL 0.66)	0.03 to 0.05 lb. a.i./acre (5.8 to 9.6 fl. oz.)
Gamma-cyhalothrin (Proaxis)	0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.)
Heligen	0.7 to 1.4 fl. oz./acre
Lambda-cyhalothrin (numerous products)	0.02 to 0.03 lb. a.i./acre
Methomyl (Lannate)	12 to 24 fl. oz./acre
Spinosad (Blackhawk)	0.038 to 0.075 lb. a.i./acre (1.7 to 3.3 fl. oz.)
Zeta-cypermethrin (Mustang MAXX, Respect EC)	0.011 to 0.025 lb. a.i./acre (1.76 to 4.0 fl. oz.)

Fall Armyworm Management Options**

Insecticide	Rate
Alpha-cypermethrin (Fastac CS)	1.8 to 3.8 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.010 to 0.022 lb. a.i./acre (1.3 to 2.8 fl. oz.)
Chlorantraniliprole (Prevathon)	14.0 to 20.0 fl. oz./acre
Deltamethrin (Delta Gold)	0.015 to 0.022 lb. a.i./acre (1.3 to 1.9 fl. oz.)
Fawligen	0.5 to 2.0 fl. oz./acre
Gamma-cyhalothrin (Proaxis)	0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.)
Lambda-cyhalothrin (numerous products)	0.02 to 0.03 lb. a.i./acre
Methomyl (Lannate)	0.225 to 0.45 lb. a.i./acre
Metoxyfenozide (Intrepid 2F)	0.06 to 0.19 lb. a.i./acre (4 to 12 fl. oz.)
Spinosad (Blackhawk)	0.038 to 0.075 lb. a.i./acre (1.7 to 3.3 fl. oz.)
Zeta-cypermethrin (Mustang MAXX, Respect EC)	0.011 to 0.025 lb. a.i./acre (1.76 to 4.0 fl. oz.)

Sorghum Webworm Management Options**

Insecticide	Rate
Alpha-cypermethrin (Fastac CS)	1.8 to 3.8 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.010 to 0.022 lb. a.i./acre (1.3 to 2.8 fl. oz.)
Carbaryl (Sevin 80S)	1.25 to 2.5 lb./acre
Chlorantraniliprole (Prevathon)	14.0 to 20.0 fl. oz./acre
Deltamethrin (Decis 1.5 EC)	0.012 to 0.018 lb. a.i./acre (1 to 1.5 fl. oz.)
Gamma-cyhalothrin (Proaxis)	0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.)
Lambda-cyhalothrin (numerous products)	0.02 to 0.03 lb. a.i./acre
Methomyl (Lannate LV)	1.5 pints/acre
Spinosad (Blackhawk)	0.038 to 0.075 lb. a.i./acre (1.7 to 3.3 fl. oz.)
Zeta-cypermethrin (Mustang MAXX, Respect EC)	0.011 to 0.025 lb. a.i./acre (1.76 to 4.0 fl. oz.)

Grasshopper Management Options**

Field Sprays

Insecticide	Rate
Alpha-cypermethrin (Fastac CS)	3.2 to 3.8 fl. oz./acre
Beta-cyfluthrin (Baythroid XL)	0.019 to 0.022 lb. a.i./acre (2.0 to 2.8 fl. oz.)
Chlorantraniliprole (Prevathon)	8.0 to 20.0 fl. oz./acre
Deltamethrin (Delta Gold)	0.012 to 0.018 lb. a.i./acre (1.0 to 1.5 fl. oz.)
Dimethoate (Dimethoate or Dimate)	0.5 lb. a.i./acre
Gamma-cyhalothrin (Proaxis)	0.01 to 0.015 lb. a.i./acre (2.56 to 3.84 fl. oz.)
Lambda-cyhalothrin (numerous products)	0.02 to 0.03 lb. a.i./acre
Zeta-cypermethrin (Mustang MAXX, etc.)	0.02 to 0.025 lb. a.i./acre (3.2 to 4.0 fl. oz.)

Spider Mite Management Options**

Insecticide	Rate
Dimethoate (Dimethoate or Dimate)	0.5 lb. a.i./acre
Methidathion (Supracide 2E)	0.5 lb. a.i./acre
Propargite (Comite II)	1.64 lb. a.i./acre

Sorghum Midge Management Options**

Insecticide	Rate
Cyfluthrin (Baythroid®)	1.0 to 1.3 fl. oz./acre
Cyhalothrin (Karate® 1E, Warrior®, others)	1.92 to 2.56 fl. oz./acre
Esfenvalerate (Asana® XL)	2.9 to 5.8 fl. oz./acre
Malathion (Fyanon® ULV)	8.0 to 12.0 fl. oz./acre
Methonyl (Lannate®)	
2.4 LV	12.0 to 24.0 oz./acre
90WSP	4.0 to 8.0 oz./acre
Zeta-cypermethrin (Mustang Max®)	1.28 to 4.0 fl. oz./acre

Grasshopper Management Options**

Noncrop Area Treatments

Insecticide	Rate	Special Instructions
Acephate (Bracket 90 Orthene 75S)	0.28 lb./acre (4 oz.) (Bracket 90), ⅓ lb./acre (Orthene 75S)	Apply in 10 to 20 gallons by ground, or in 1 to 5 gallons by air. Use as a treatment on ditch banks, roadsides, and field borders. Do not feed or graze treated forage.
Beta-cyfluthrin (Baythroid XL)	2.6 to 2.8 fl. oz./acre	Labeled for use in pastures, rangeland, grass for hay, grass for seed. PHI is 0 days.
Diflubenzuron (Dimilin 2L)	2 fl. oz./acre	Apply to manage grasshoppers in breeding areas before they move into crop land. Treat early instars (majority in the second to third nymphal stages). For use on field border, fence rows, roadsides, farmsteads, ditchbanks, wasteland, and CRP land. REI is 12 hours.
Esfenvalerate (Asana XL)	0.015 to 0.03 lb. a.i./acre (2.9 to 5.8 fl.oz./acre of Asana XL)	This label is for noncrop use on land adjacent to tilled area to control migrating insects. Repeat as needed, but do not exceed 0.5 lb. a.i./acre per year. Do not feed the treated vegetation. Do not spray ditch banks or areas adjacent to water.
Gamma-cyhalothrin (Proaxis)	0.0075 to 0.015 lb. a.i./acre, 1.92 to 3.84 fl. oz./acre	Spray non-cropland adjacent to agricultural areas to control migratory insects that may threaten crops. Use highest labeled rates for dense/tall foliage, high insect populations and/or larger insects. Do not graze livestock in treated area. REI is 24 hours.
Lambda-cyhalothrin (Grizzly Z)	0.02 to 0.03 lb. a.i./acre or 2.56 to 3.84 fl. oz.	Spray non-cropland adjacent to agricultural areas to control migratory insects that may threaten crops. Use highest labeled rates for dense/tall foliage, high insect populations and/or larger insects. Do not graze livestock in treated area. REI is 24 hours.
Zeta-cypermethrin (Mustang Maxx)	0.0175 to 0.025 lb. a.i./acre or 2.8 to 4.0 fl. oz./acre	Labeled for use on grass forage, fodder, pasture, and rangeland with a 12 hour REI and a 0-day harvest restriction on forage. Thus, this material may be used to treat these areas when grasshoppers are threatening to move from these areas into neighboring crop fields.

Sorghum Insecticide Use Instructions**

Insecticide	Special Instructions
Afidopyropen (Sefina)	Do not apply more than 12 fl. oz. (0.04 lb afidopyropen ai) per acre per year. Do not make applications less than 14 days apart. PHI 7 days for forage, 14 days for grain and stover. Apply Sefina at spray volumes sufficient to ensure thorough crop coverage for optimal performance. Minimum spray carrier volume (per acre): 15 gallons for ground, 3 gallons for air. Use of an adjuvant may improve performance.
Alpha-cypermethrin* (Fastac CS)	Do not use any products containing cypermethrin and zeta-cypermethrin during a crop season when using Fastac. Do not make applications less than 10 days apart. Do not apply more than 11.4 fl. oz. (0.075 lb. a.i.) per acre per season. PHI is 14 days for grain; 45 days for stover.
Beta-cyfluthrin* (Baythroid XL)	Minimum application volume (water) is 2 gallons for aerial application and 10 gallons by ground. REI is 12 hours. PHI is 14 days.
Carbaryl (Sevin)	Do not use within 14 days of harvest or grazing for forage use. REI is 12 hours. PHI is 21 days.
Chlorantraniliprole (Prevathon)	Do not make more than four applications per acre per crop. Minimum interval between treatments is 7 days. Do not apply more than 60 fl. oz. or 0.2 lb. a.i. of chlorantraniliprole per acre per year. REI is 4 hours. PHI is 0 days.
Deltamethrin* (Delta Gold)	Minimum application volume (water) is 2 gallons for aerial application and 5 gallons by ground. REI is 12 hours. PHI is 14 days. Do not cut or graze sorghum forage within 14 days of application.
Dimethoate (Dimethoate or Dimate)	Minimum application volume (water) is 2 gallons for aerial application and 5 gallons by ground. REI is 12 hours. PHI is 14 days. Do not cut or graze sorghum forage within 14 days of application. Do not apply after heading. Up to three applications permitted.
Esfenvalerate* (Asana XL 0.66 EC)	Apply by ground or air equipment. Do not exceed 0.15 lb. a.i./acre per season. PHI is 21 days. This use pattern may not appear on the federal label. See Supplemental Labeling EPA Reg. No. 352-515 issued in 1998. REI is 24 hours.
Flupyradifurone (Sivanto Prime)	Use a minimum application volume of 10 gal./acre by ground or 3 gal./acre by air. Minimal interval between applications is 7 days. Do not apply more than 0.365 lb. flupyradifurone per acre per calendar year. PHI is 7 days for hay or forage and 21 days for dried grain, stover, or straw.
Gamma-cyhalothrin* (Proaxis)	Apply with ground or air equipment, using sufficient water and application methods to obtain full coverage of foliage. When applying by air, apply in a minimum of 2 gallons of water per acre. Do not apply more than 0.03 lb. a.i. (0.48 pint) per acre per season after crop emergence and do not apply more than 0.01 lb. a.i. (0.16 pint) per acre once crop is in soft dough stage. REI is 24 hr. PHI is 30 days.
Lambda-cyhalothrin* (numerous products including Warrior II with Zeon Technology, Silencer, Taiga Z, and Lambda T)	Apply by ground or air in sufficient gallonage to obtain full coverage. Use a minimum of 2 gallons of water per acre by air. Do not apply more than 0.02 lb. a.i./acre once crop is in the soft dough stage. Do not graze livestock in treated areas or harvest for fodder, silage or hay. REI is 24 hours. PHI is 30 days.
Malathion	This organophosphate insecticide is available from several suppliers and in various formulations, but only some labels list sorghum as an application site. REI is 12 hours. PHI 7 days. Read labels closely.
Methidathion* (Supracide 2E)	May cause phytotoxicity on some sorghum hybrids. PHI is 30 days. REI is 48 hours. Use for greenbug based on SLN label.
Methomyl* (Lannate)	Apply in a minimum of 10 gallons per acre by ground or 2 gallons by air. REI is 48 hours. PHI is 14 days for grain or grazing.
Metoxyfenozide (Intrepid 2F)	Do not apply more than 12 fl. oz./acre per application or 48 fl. oz. of Intrepid 2F (0.75 lb. a.i.) per acre per year.
Spinosad (Blackhawk)	Apply in 2 to 5 gallons of water per acre by air or in a minimum of 5 gallons by ground. Time application to coincide with peak egg hatch. Do not apply more than 12.4 fl. oz./acre per year. REI is 4 hours. PHI 3 days for grain or fodder or within 21 days for forage.
Zeta-cypermethrin* (Mustang MAXX, Respect EC)	Apply in a minimum of 10 gallons of water by ground or 2 gallons by air. Do not make applications less than 10 days apart. Do not apply more than 0.125 lb. a.i./acre per season. REI is 12 hours. PHI is 14 days for grain and stover, and 45 days for forage.

* Restricted Use Pesticide

** For use rate and any other information relative to any insecticide listed in these tables please ALWAYS consult the actual label on the product.

B. P. McCornack and R. J. Whitworth
Department of Entomology

Publications from Kansas State University are available at *bookstore.ksre.ksu.edu*

Kansas State University Agricultural Experiment Station and Cooperative Extension Service
K-State Research and Extension is an equal opportunity provider and employer. Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of K-State Research and Extension, Kansas State University, County Extension Councils, Extension Districts.

MF742 | February 2022